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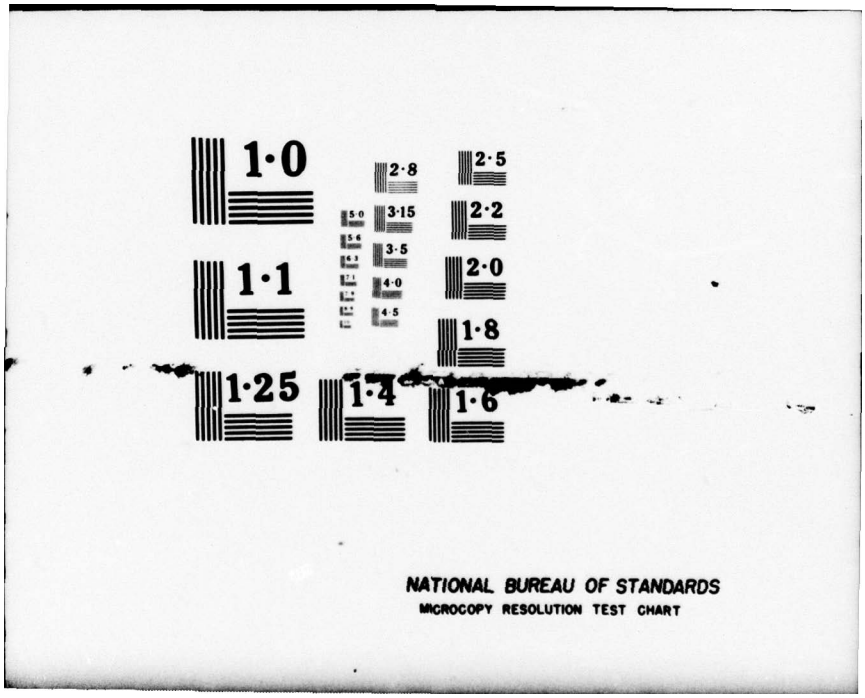
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NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

AN ANALYSIS OF AIRCRAFT MODIFICATIONS
AND INTEGRATED LOGISTIC SUPPORT
IN THE F-4 AIRCRAFT

by

Curtis Stanley Hunter, Jr.

March 1977

Thesis Advisor: E. A. Zabrycki

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An Analysis of Aircraft Modifications and Integrated Logistic Support in the F-4 Aircraft

by

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Submitted in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE IN MANAGEMENT

from the

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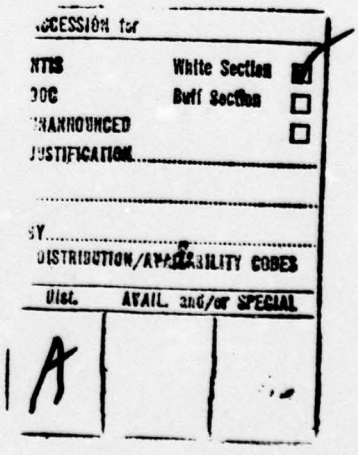

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KEY TO ABBREVIATIONS

AFC -	Airframe Change
APN -	Aircraft Procurement, Navy funds
AVC -	Avionics Change
CCB -	Configuration Control Board
CNAP -	Commander Naval Air Forces Pacific
CNO -	Chief of Naval Operations
ECP -	Engineering Change Proposal
GE -	General Electric
ILS -	Integrated Logistic Support
ILSMT -	Integrated Logistic Support Management Team
LEM -	Logistic Element Manager
LM -	Logistic Manager
MEA -	Maintenance Engineering Analysis
MDC -	McDonnell Douglas Corporation
NARF -	Naval Air Rework Facility
NAVAIR -	Naval Air Systems Command Headquarters
NI -	North Island Naval Air Rework Facility
OMN -	Operation and Maintenance, Navy funds
SSE -	Special Support Equipment
TD -	Technical Directive
WSM -	Weapon System Manager

I. INTRODUCTION

A. PURPOSE AND OBJECTIVES

Integrated Logistics Support (ILS) has left its infancy and has become an important link in the management of today's Naval Weapon Systems. As a supply officer involved in aviation supply support for several years, the author has developed a personal interest in the ILS program especially as it relates to aircraft modifications.

If one looks at the official correspondence relating to aircraft modifications, it is immediately apparent that a number of problems exist and recur with startling regularity. Continually seeing these problems the reasonable man begins to hypothesize that there is something wrong with the way the aircraft modification programs are managed.

With this hypothesis in mind it was decided that a study of the change process and how it relates to the integrated logistic support program would be an effective means of determining what real problems exist and what could be done about them. The objectives of the study were two fold, first to gain a good knowledge of the details of the aircraft modification process, how it is managed and how it relates to ongoing ILS programs and secondly, from information gathered in the study to be able to make recommendations for increasing the effectiveness of the change process.

B. RESEARCH HYPOTHESIS AND METHODOLOGY

Based on the thesis that there are problems within the change system, a research effort was designed to identify and substantiate these problems. This would permit gathering of data which could show basic reasons for the problems and allow recommendations for their solution.

The research began with a review of current literature on ILS and changes. It was almost immediately discovered that while there has been much writing and research done about the field of ILS, there is no mention of modifications outside of the basic Navy directives pertaining to the subject. The information on ILS, however provided many details that related to the change process.

A series of personal and telephonic interviews were then conducted with people involved in the ILS and modification programs. These people who were involved at various points in the change process included personnel at the Aviation Supply Office, Commander Naval Air Pacific (CNAP) Headquarters, Naval Air Systems Command Representative Pacific (NAVAIRSYSCOMREPAC), the F-4 Weapon System Managers Office, the S-3 Assistant Program Manager for logistic office, the S-3 contractor, Lockheed and Navy Plant Representative Office, Burbank, California, and Naval Air Systems Command Headquarters.

As a result of the interviews, numerous areas for investigation were reviewed and the scope of the thesis was narrowed to one aircraft,

the F-4. The choice of aircraft for study was based on availability of data from the F-4 weapon system manager (WSM) and the author's working relationship with the F-4 WSM personnel from a previous tour at the Aviation Supply Office where he was in charge of F-4 supply support.

The data to show agreement with or variance from the change process was to come from files maintained by the F-4 Logistic Manager on each Engineering Change proposal. The specific items for review and data collection were a series of forms completed as a result of the change approval which showed planned milestones for the change installation and approved funds for the change. These summaries were submitted annually for funding approval, so it was anticipated that a history of the change showing whether it was meeting planned milestones could be ascertained. The forms to be reviewed were:

CCB Change Request NAVAIR Form 13050/2

ECP Milestone Chart NAVAIR Form 13051/5

ECP Cost and Funding Summary NAVAIR Form 13051/4.

In addition to these the McDonnell Douglas Report P.S. 408: USN F-4 Composite ILS ECP Status provided information on planned time schedules for support elements.

Changes for review were to be selected at random from the approximately 1000 F-4 changes. This was to be accomplished by drawing a random number representing each change. However, after the first selection of 10 changes it was found that the data in these change files

was inadequate for study. Further investigation found that change files prior to 1972 when the WSM moved to North Island had not been fully maintained and that active files subsequent to this time had better data. Additional changes were then selected, seeking files that had adequate data for review. Two changes which required fund reprogramming were specifically selected for reviewing their impact on the change process.

Several limitations on the study are recognized. First the amount of data with which to work was limited since funding was available for only one short trip to collect data. Second, the data from the Logistic Manager's files was incomplete. This lack of data made it necessary to vary from a random selection of files for review. However, even without total random selection, discussions with LM personnel indicated that the changes selected for examination in this thesis were representative of the change situation on the F-4.

C. THESIS ORGANIZATION

The next two chapters were designed to synthesize information gathered from the literature search and the numerous interviews conducted. Chapter II is a review of the ILS program and definition of the change process as defined in appropriate directives. Chapter III delineates the major problems that became apparent in this early research effort and points out their possible impact on various areas

of the change process. The last two chapters display the data collected showing what is actually happening as opposed to what was planned, an analysis of the data gathered, and provide conclusions and recommended actions.

II. ILS AND CHANGES

A. ILS BACKGROUND

In the 1950's DOD recognized that there was a need to streamline the procurement process. This resulted in the development of centralized program management as opposed to task oriented management. This concept served as a vehicle to integrate the contributions of a number of technical specialties including logistic support in the performance of a common project. Over a period of time, increased recognition of this type of management as the key to optimal weapon system development has led to additional responsibility accruing to the project manager and his staff, and the concept of project management has now become standard in the field of aircraft acquisition.

Integrated Logistic Support (ILS) being a major part of project management has also received increasingly more attention and has been recognized as a key factor in the weapon system acquisition process. It is defined as a composite of all the support considerations necessary to assure the effective and economical support of systems/ equipment / for their life cycle and is characterized by harmony and coherence among all the logistic elements, those elements being:[1]

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[1]NAVMAT INST 4000.20A MAT 042/CMC p. 55, 18 Mar., 1971.

Maintenance plan

Support and Test equipment

Supply support

Transportation and handling

Technical data

Facilities

Personnel and Training

Logistic Support Resource funds

Logistic support management information.

ILS, then, is a management function that provides controls to help assure that the ultimate consumer will receive a system that will not only meet performance requirements, but one which can be expeditiously and economically supported throughout its programmed life cycle.[2] Early in the weapon system development phases, logistic studies are done, tradeoff factors identified, and trade-offs made which will define the logistic parameters of the weapon system and serve as the basis for all future logistic support. The ultimate results of these decisions are communicated to those participating in the acquisition process through the Integrated Logistic Support Plan (ILSP). This document contains milestones, delivery points, names and responsibilities of persons accountable for each support element, guidance on

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[2]Blanchard, B.S., Logistics Engineering and Management, p. 298, Prentice-Hall, Inc., 1974.

the logistic system desired, interdependencies among personnel, as well as the monitoring and communications system for passing information among the participants. The responsibility for implementation of the plan and monitoring its progress is assigned to a Logistics Manager (LM) who heads up the weapon's logistic support organization and who is responsible to the project manager.

B. THE CHANGE PROCESS

Once a sophisticated aircraft weapon system is introduced into the fleet it begins to undergo a series of changes. The need for these changes is the result of several factors. Primary among these is long range planning for aircraft improvement which entails upgrading installed equipment to new technology, correcting deficiencies in design and improving maintenance capabilities. Unexpected failures such as structural failure or problems arising from installation of the changes themselves can also be problem areas.

These changes are implemented through the Technical Directive (TD) system. NAVAIR INST 5215.8A establishes the TD system with the technical directive being the instrument that authorizes installation of the change and provides direction for the installation and related maintenance functions.

A flow diagram of the change process is shown in figure 1. This diagram was compiled from information obtained from the F-4 logistic manager, AR 41 and MIL-STD-480. This process begins as much as

THE CHANGE PROCESS

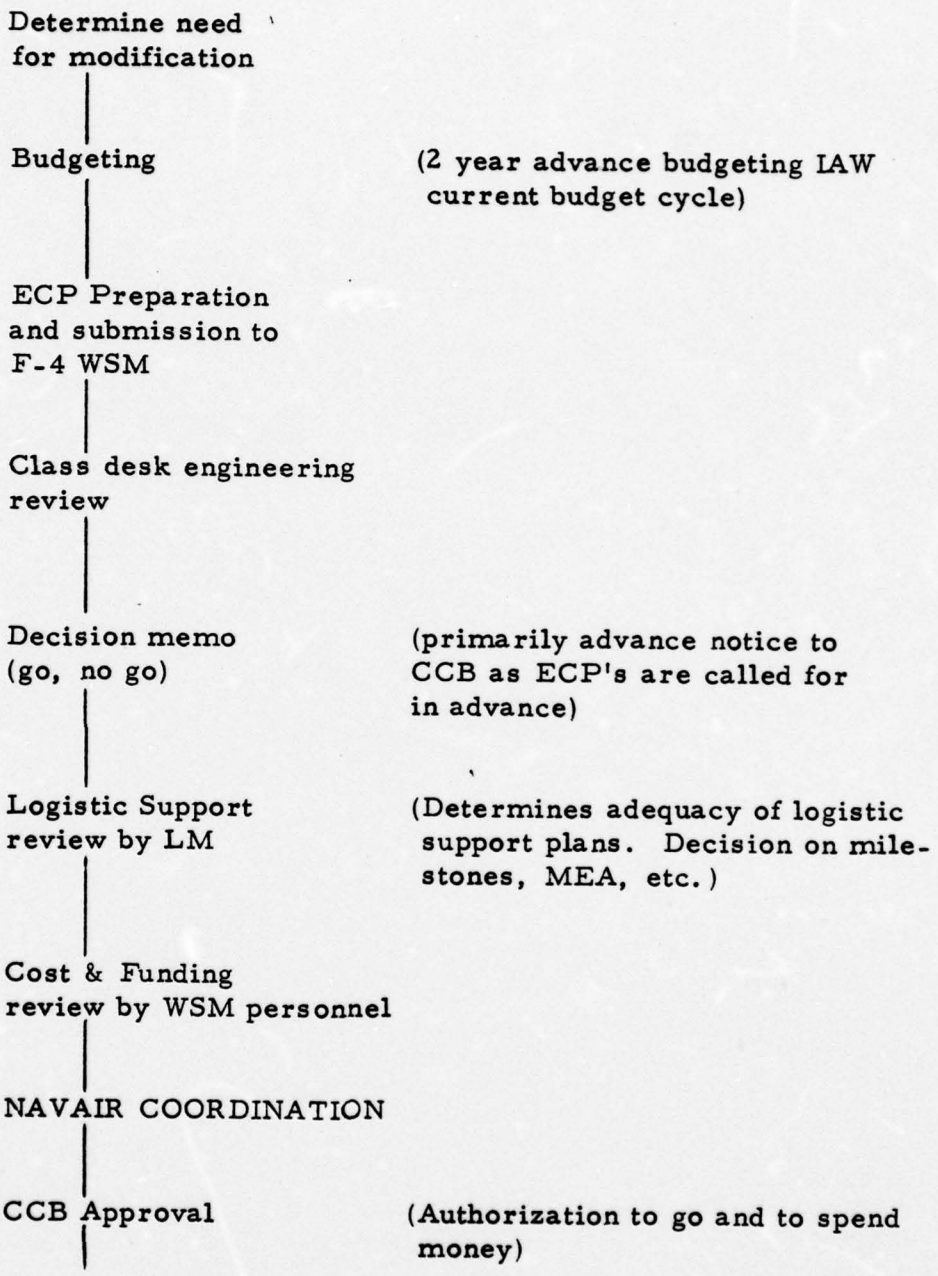

Figure 1

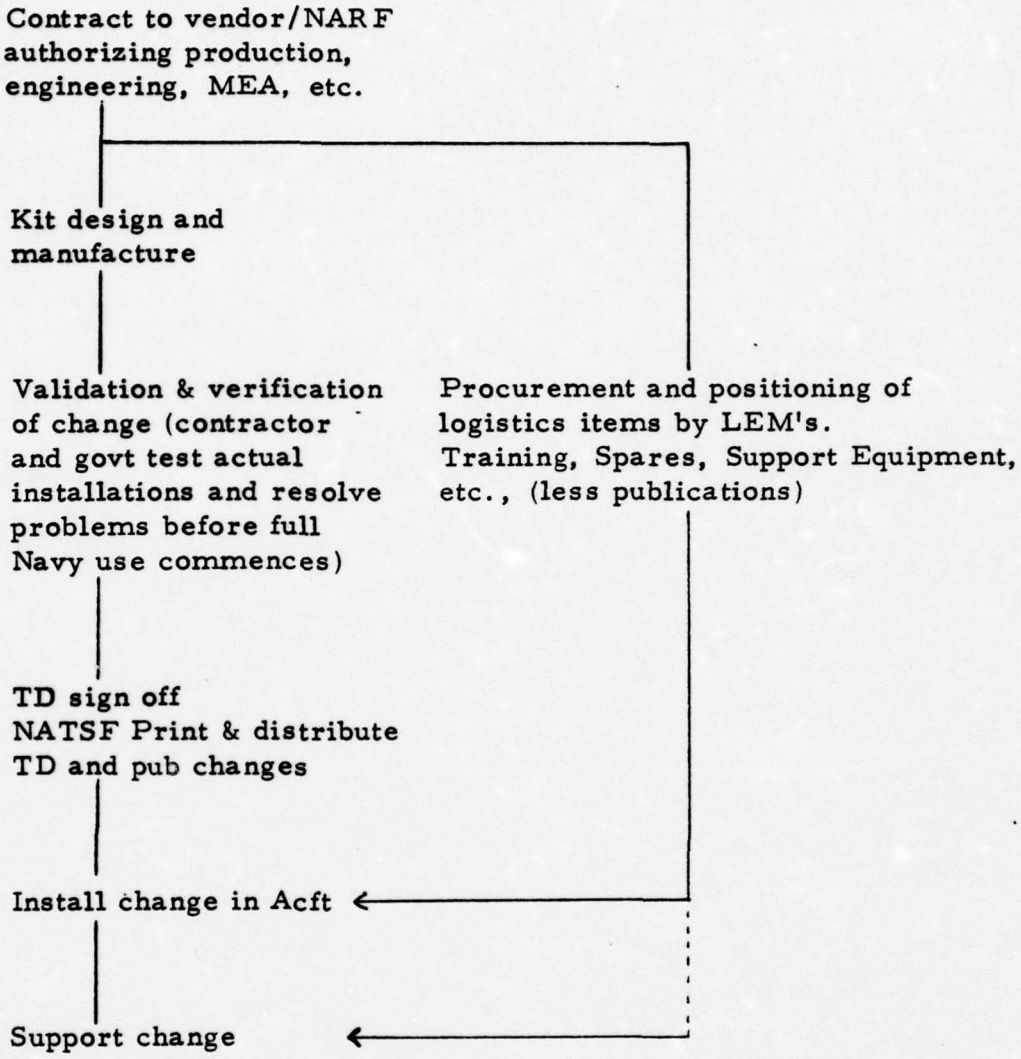
Contract to vendor/NARF authorizing production, engineering, MEA, etc.
Kit design and manufacture
Validation & verification of change (contractor and govt test actual installations and resolve problems before full Navy use commences)
Procurement and positioning of logistics items by LEM's. Training, Spares, Support Equipment, etc., (less publications)
TD sign off
NATSF Print & distribute TD and pub changes
Install change in Acft
Support change

Figure 1

two years before change approval in order for funding requirements to meet deadlines for inclusion in the Congressional budgeting process. Early engineering analysis is accomplished during the Engineering Change Proposal (ECP) preparation. The completed ECP is then submitted to the WSM who makes final funding and logistical analyses before sending the ECP to NAVAIR and the Configuration Control Board (CCB) for approval. Once the change is approved, funds may be obligated for production of the change hardware and logistic items.

At this point the LM is responsible for monitoring the logistic support implementation program which includes the procurement of the logistic elements by the Logistic Element Managers and installation kit procurement. After validation and verification, the technical directive is signed, printed and distributed. Installation of the change may now commence. Based on the magnitude of the change, the need for quantitative ILS action ranges from almost none to the assembling of the complete ILS team for a period of years.[3]

C. THE FUNDING

The seeking of dollars to support the change program begins with the submission of requirements for inclusion in the Congressional budget two fiscal years in advance of expected use. The LM submits funding requirements to support changes with calculations based on his

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[3] The direction for ILS involvement in the change process comes from NAVMAT INST 4000.20 and NAVAIR 4000.3 which are not referenced in instructions relating to the TD system.

expertise, estimates provided by the Naval Air Rework Facility (NARF) engineers, contractor estimates and inputs from Logistic Element Managers (LEMs). The LM is concerned with providing dollars for his program in three specific accounts:

APN-5 Modification money which buys hardware, non-recurring engineering effort, contractor installation of changes, and aircraft modification kits.

APN-6 These funds are used to procure spares, repair parts and kits to modify spares.

OMN Operations and maintenance Navy funds are allocated as a 'pot' of money to various activities and used for installation of changes and modification of spares by the NARF as well as procurement of consumable repair parts.

The requested budget flows up the Navy and DOD budget chain to Congress and the approved funds come back to the LM via NAVAIR. While this set of channels has its own impact on the budget, a specific concern of this thesis is the examination of fund flows after the CCB approves expenditure of funds on a change. It is at this time that funds should be firm and traceable through their expenditure channels. Figure 2 shows a simplified fund flow to a commercial contractor for APN-5 and APN-6 funds. In the case of OMN funds, a project order would be issued to the NARF by AIR-4148 after issue of the project directive by AIR-1041.

FUND FLOWS AFTER CHANGE CONTROL BOARD APPROVAL OF CHANGE

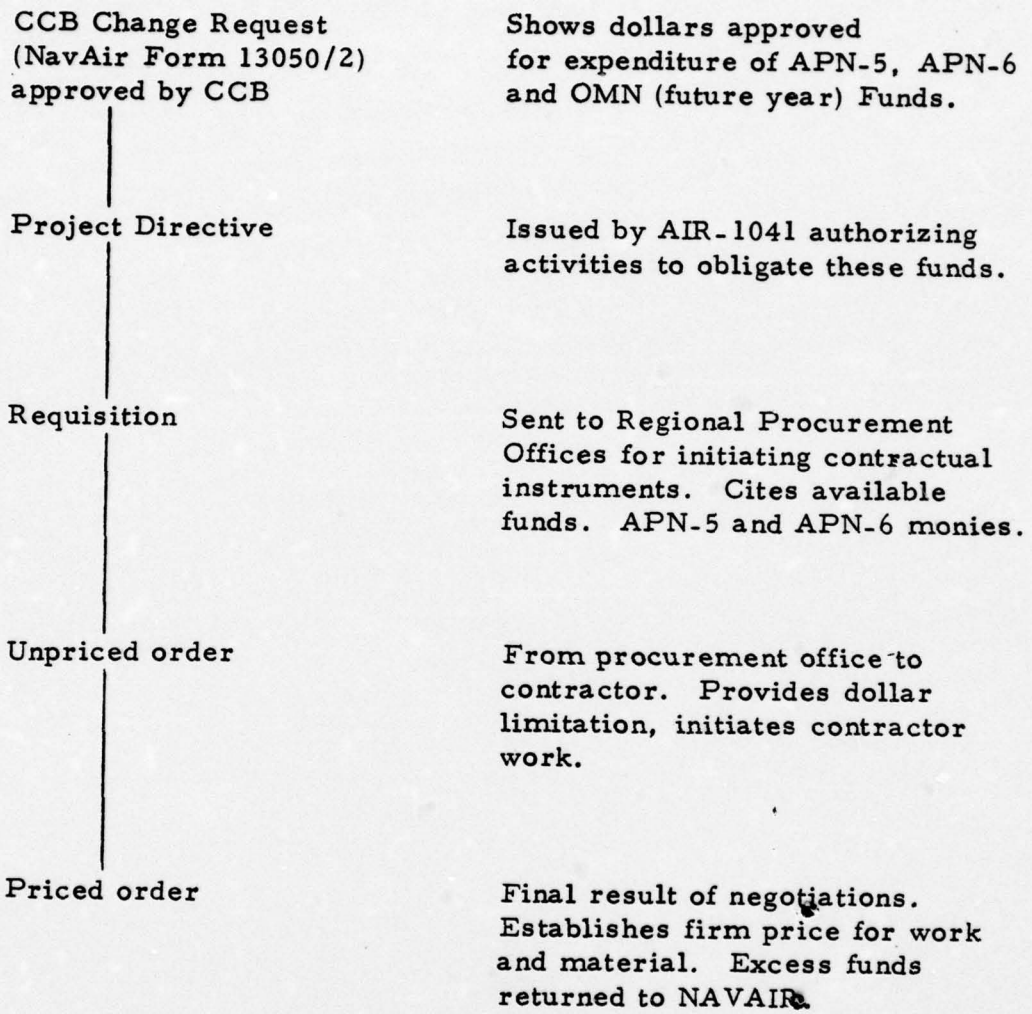

Figure 2

D. THE ORGANIZATION

The ILS organization begins in the Navy with the Chief of Naval Operations where the Deputy CNO for Logistics has the specific responsibility for direction and coordination of Navy ILS efforts. The Chief of Navy Material (NAVMAT) is responsible for ILS policy promulgation, ILS training and ILS career development programs. As directed by CNO and NAVMAT, each weapons acquisition project has an Integrated Logistic Support Manager (LM) assigned who carries out his functions in accordance with NAVMAT INST 4000.20. The LM or APML (Assistant Project Manager for Logistics) must have a broad background in logistic management functions and have a knowledge of engineering design and development, PPBS (Planning, Programming and Budgeting System), procurement processes and operational needs. He in turn directs the entire logistic support program for his weapon system.

The LM works within one of two different types of organization, either a hierarchal organization or a matrix organization. Within NAVAIR most of the LM's are in a matrix organization reporting directly to AIR 04 and laterally reporting to weapon system project managers in the NAVAIR Project Management Office. In the case of small acquisitions there may be a LM responsible for several different projects and working for different project offices. This type of organization permits the project office to draw on a large range of expertise

within the NAVAIR organization without having to be concerned about full time employment of people and equipment in support of a single weapons system.

A hierarchal organization exists in the cases where a weapon systems manager has been established in accordance with NAVAIR INST 5400.70. This is the case of the LM for the F-4 who works directly for the F-4 WSM and is at the same level as his key counterpart at the Class Desk. This relationship is shown in figure 3.[4]

While the F-4 Logistic Manager himself is now in a hierarchal chain of command, he is responsible for overseeing the total support of the weapon system as it is implemented by numerous separate Navy commands. His means of program monitoring and control is through a matrix organization of command representatives known as the Integrated Logistic Support Management Team (ILSMT). The major participants in this team are the Logistic Element Managers (LEM) which are the activities responsible for the acquisition of the key support elements such as publications, spare parts, support equipment and training. Each LEM provides representation on the F-4 ILSMT. This representative is responsible to his own command as well as to the LM for insuring adequate planning control and coordination of his activity's actions in support of the ILS program. He is expected to insure that

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[4]The rationale for better management control and conflict reduction within the hierarchal organization vs the matrix organization is discussed by Brittain and Fox.

F-4 WEAPON SYSTEM MANAGER ORGANIZATION

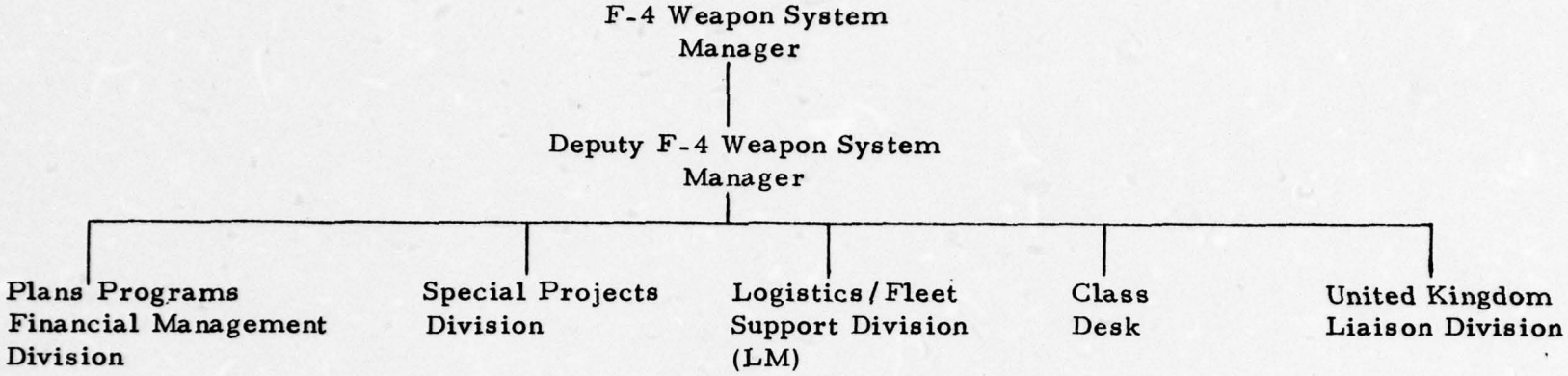

Figure 3

milestones in the ILSP are met. In addition the LEM must maintain communications with both the LM and other LEMs and team members in carrying out his part of the process. Figure 4 shows the F4B-N conversion ILS team which is composed of 15 members from 14 different commands and is representative of a typical ILS team.

E. THE AUTHORITY, ACCOUNTABILITY AND RESPONSIBILITY OF THE LOGISTICS MANAGER

The authority, accountability, and responsibility held by the logistics manager is of prime importance in ILS. His job as the LM begins during the early stages of system inception and includes such functions as establishing objectives, organizing ILS functions, and directing and controlling the program to insure objectives are met. The job continues until the weapon system is phased out of the Navy inventory.

The F-4 LM is accountable for his Integrated Logistic Support Program to the Weapon System Manager and through him to the Commander NAVAIR as outlined in NAVMAT INST 4000.20 and NAVAIR INST 5400.70. These instructions hold him accountable for the outcome of the ILS effort and assign specific management responsibilities including inputs in change planning, preparing and defending budgets on changes, and insuring that all ILS elements are procured and in place at the proper time.

By way of authority, the LM carries the power of Commander Naval Air Systems Command in his dealings with other commands.

ILS MANAGEMENT TEAM COMPOSITION

CHAIRMAN

F4 Logistic Manager

TEAM MEMBERS F4B-N ILS TEAM

Naval Air Rework Facility, North Island (314)

Air Force Plant Representative Office, St. Louis (PDO)

* Aviation Supply Office (SCW1-1A)

Commandant of the Marine Corps (AAJ)

Commanding General, Fourth Marine Air Wing (15)

Chief of Naval Operations (OP-506C)

Commander Naval Air Forces Atlantic (522B)

Commander Naval Air Forces Pacific (725)

Chief of Naval Reserve (32)

McDonnell Douglas Corporation (D501)

* Naval Air Engineering Center (92A41)

* Naval Aviation Maintenance Training Group (322)

* Naval Air Technical Services Facility (218)

Naval Air Systems Command (53441)

Naval Air Systems Command Representative, Pacific (33411)

*Key Logistic Element Managers

Figure 4

Specific authority is given to him to organize an ILSMT for any system or equipment that he deems in need of it. Through the ILSP he has the authority to require specific actions of the LEMs in supporting his program.

III. PROBLEMS OF ILS AND CHANGES

It is the purpose of this chapter to synthesize the results of the literature search and personnel interviews conducted to show the major ILS and modification problem areas that were disclosed. These problem areas fell into three groupings; personnel management, via the matrix organization; money management; and time problems, all of which affected or are affected by the authority, accountability, and responsibility of the LM. Each of these problem areas is discussed in light of its possible impact on the change process as illustrated in Chapter II.

A. MANAGEMENT OF THE MATRIX ORGANIZATION BY THE LM

As discussed in Chapter II the weapon system manager must coordinate the efforts of many commands in the ILSMT matrix organization. The advantage within the Navy is that this type of organization provides a problem solving channel which can focus on a single weapon system bringing together the knowledge and experience of a diversity of talent to solve complex problems. This is an important capability in the management of present day complex weapon systems. However, the existence of the matrix organization brings many new management problems before the LM that are not present in hierarchal organizations. For example, the hierarchal organization has very specific relationships

defined through its organization chart but does not show what relationships must be formed within the organization in order to complete its work, a problem that the matrix organization endeavors to solve. The power of the organization is in its hierarchy, but people in the matrix organization are expected to communicate laterally as well as vertically. Also, as Kingdon points out in his book on the matrix organization, there has been no program that teaches people the interpersonal skills necessary for this kind of participation.

The management of an inter-command organization like the ILSMT is even more complicated by the existence of differing goals, objectives, and organizations within each command. This forces the LM to have to deal with conflicting interests and organizational outputs that are often not consistent with his goals. In his examination of the Harpoon ILS organization, Brattain noted that it was evident that the ILSMT members were not focusing on the goals of the program, but rather on the goals of their own commands. This situation is not unpredictable when it is recognized that for any individual team member the measure of his success is the personnel evaluation which is completed by the command to which he belongs. The ILS team member is serving two or more masters in the matrix and hierarchal organizations creating the problem of an individual jeopardizing his position with one boss by consulting with another boss.

The above conditions are further aggravated when the concept of management control of work is considered. The establishment of objectives, priorities, and schedules becomes an almost unsurmountable task when the multitude of changes in process at any point in time is considered. Lack of effective control may mean that actions are not completed. Individual workers subject to numerous demands for their time apply themselves to satisfying those individuals placing the strongest demands on them at any one time.

Even at operating levels of command, the commanders prerogative to make decisions is recognized and preserved. In the case of modifications the Technical Directive System very specifically states: "Nothing in this instruction precludes or modifies the operating commander's prerogative to take any action he deems necessary to insure the safe operation of assigned aircraft and aeronautical equipments."[5] This authority leaves open the possibility of not installing changes, installing changes before scheduled dates, and other operating level decisions that will affect the ability of ILS to provide continued effective support of the weapon system and its modifications unless it is actively communicated to the ILS team in a timely fashion.

Another major area wherein the LM and team members will encounter problems is the field of communications. The requirements of ILS in the matrix organization place new communications burdens

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[5]NAVAIR INST 5215.8A. The NAVAIR Technical Directive System, p. 1-2, 14 March 1973.

on the individual. Now, not only must he communicate vertically but he must communicate laterally within his own organization and within the structure of the ILS team with the purpose of resolving problems that reduce the effectiveness of the ILS program. The individual must be able to communicate with people of many different backgrounds and goals. In the case of the LEM it becomes important that all employees are informed about the "big picture," where their job fits into it and how they are expected to support and further the organization goals through such subsidiary programs as ILS. The failure of communications can cause incomplete and uncoordinated output, reducing the effectiveness of ILS programs.

All of these problem areas create conditions for an atmosphere of conflict as do the separate formal and informal groups existing within the various commands. Yet, while one of the major functions of ILS is technical conflict resolution, it may fail to resolve the personal conflict of individuals involved in the process. The failure to resolve individual conflict problems can, in the long run, certainly be expected to result in actions unfavorable to the desired outcome of ILS programs.

This leads immediately to the topic of individual motivation as a factor in ILS management. The complexities of the program, the multitude of changes and the varying demands on an individual's time can be major factors affecting the motivation of any individual in the

organization. The individual ILSMT member must also adjust to the ILSMT organization and be motivated to operate within its bounds. This means that the person must become a part of the group. He must gain some understanding of the jobs of other people in the ILS program and the impact of his actions on their parts of the program. Above all, he must learn to value the perspectives of others.

B. FUNDING

One of the key problems identified from both literature examined and interviews conducted is that of control of funds throughout the change process. The budget process itself involves a great deal of risk from the time of budgeting until funds are actually made available to the LM. However, even then the LM may not have control since funds are allocated to various LEM's to spend without any requirement to report expenditures to the LM. The distribution of OMN dollars is done as a 'pot'of money to various activities. Such funds are not identified for use on specific changes. Over-spending by the activity on one project will cause problems on another project with no prediction as to which projects will be in trouble as a result of a shortage of funds.

In contrast to the pot concept for activities within the Navy, contractors are given funds tied to specific contracts with specified results expected and penalties exacted for failure to meet contractual requirements. This provides a greater degree of control for the LM,

but even this system has its loopholes. Contractors have certain opportunities for fund manipulations that cannot be traced through the accounting system. As an example, a contractor can install a compatability change in a production aircraft utilizing existing funds without approval of NAVAIR or the project manager. Such action obviously affects immediate funds and other installations that were planned, as well as the need for future support of the new change installed by the contractor.

Even after the project manager has been authorized his funds, they may be reallocated by NAVAIR to satisfy the urgent requirements of other weapon systems. This reallocation effort can take the form of an across the board cut in funds which may not permit identification of programs or changes affected. An example of where 26 million dollars in OMN funds allocated for rework of F-4 aircraft was used for rework of other aircraft illustrates this point. What the 26 million dollars were actually spent on remains uncertain.[6] Even worse, the impact of one such action is not assessed in relation to other elements of the change process that are also in motion. The lack of OMN dollars at the NARF may preclude installation of a change for a year or more but funds given to a LEM for supply support, trainers, etc., that were not affected can continue to be spent as if all were well.

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[6]Naval Audit Service Western Region. Audit Report Z60046-Interservice Audit of Material Readiness of Selected Forces, Department of the Navy, 15 Oct 1976, p. V-9.

Such actions result in overexpenditure in some areas and rebudgeting in other areas of the same program.

This reallocation of funds from one program to another is technically known as reprogramming and can happen at all levels of command. While there is overall guidance, rules for reprogramming funds are not extensive, and the ability to do it is interpreted as flexibility in fund management. At the lowest level the LM may need additional funds for an unbudgeted requirement or for an already budgeted one. For small needs he may use his own existing funds. For larger requirements he must go to NAVAIR who can use its prerogative to reprogram funds. However, by convention, requirements ranging from 1 to 5 million must go to CNO. Congress must approve reprogramming of funds greater than 5 million.

An increasing inventory of uninstalled modification kits and requests for increased installation monies has brought some of these budgeting and funding problems to the attention of Congress, who is taking an active interest in devising policies that will reduce the modification budget and effect better management of modification programs. On the subject of reprogramming, Congress has decreed that action will be taken to prevent the need for congressional reprogramming approval. Specific rules as to when reprogramming is absolutely not permitted were established and are of interest.

- DOD may not request items previously denied by Congress.
- When high priority programs slip, these funds may not be reprogrammed to lower priority projects.
- RDT&E funds may not be reprogrammed to lower priority projects and then requested again in another FY.
- Reprogramming at below 'threshold' dollars several times to get needed dollars at or above threshold is not permitted.[7]

It would thus seem that increased emphasis on management of these funds is necessitating changes in the way the Navy carries out its modification programs. Need for such change is also discussed by the Navy Audit Service pointing out the problem of lack of comparison of accomplishment of a program to the approved program to determine how shifts in funds have affected the weapon system. Such a problem also highlights their comment that there is no uniform basis for comparing readiness to funding.[8]

C. TIME

While the problem of time is not specifically addressed as a problem in the literature search, it was brought out as a factor which affected modification management by several people interviewed. It

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[7]House Committee on Appropriations Report 93-662, 26 Nov 1973.

[8]Naval Audit Service Western Region. Audit Report 260046 Inter-Service Audit of Material Readiness of Selected Forces, Department of the Navy, 15 October 1976, pp. II-3 - II-4.

It usually shows itself in the form of a delay either in actual schedule or planned schedule and can affect installation rate and costs, funding available, adequacy of engineering effort, and contractor production schedules. Early completion of efforts can also cause problems such as installation of change in aircraft prior to support elements being available, or delivery of support elements prior to verification and validation which may cause changes to the elements already delivered.

Funds normally are approved for obligation in only one fiscal year and any delay in this obligation process may mean the loss of use of funds in that fiscal year with consequent excess requirements the next fiscal year. In those situations where funds are alloted to other activities without specific spending instructions, this problem may exist but is hidden in the total expenditure of the funds.

The number of changes and the many actions required to implement each one begin to take their toll on the time available to manage them as there is also competition for this time from major ongoing programs of which changes have been historically considered only a minor part. As a result, supporting activities are currently seeking ways to improve change management by such means as mechanizing change information and reducing paper work flow time between contractor and LEM's in procurement actions.

D. AUTHORITY, ACCOUNTABILITY, RESPONSIBILITY, PROBLEM AREAS

The problems discussed above indicate that there are areas where the logistic manager does not have full control over all elements of the change process. This was also discussed by Price and Deal who concluded that the most significant result of their study was the evidence of the need for more authority for the LM.[9] The Naval Audit Service investigation of the F-4 noted this problem also and stated that there was a widespread decoupling of accountability, responsibility and authority.[10]

The area of budgeting, funding and expenditure of funds obviously has an impact on LM's ability to manage and control the ultimate outcome of ILS on the various changes. Lack of control of expenditure of monies once distributed may prevent the LM from predicting the ILS outcome, may increase the uncertainty factor in his planning and may not give him one of the tools needed to insure responsiveness of his element managers. Any action by higher authority to reprogram funds at an activity may affect the logistic support for a change but the LM would not be aware of it, nor of its impact until some specific delay is incurred at a later date.

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[9]Price, R.B., III, and Deal, G.W., An Analysis of the Role of the Deputy Program Manager for Logistics as viewed by various participants in the system acquisition process. Thesis. Air Force Institute of Technology, March 1973.

[10]Naval Audit Service Western Region. Audit Report Z60046, 15 Oct 76, p. II-2.

The LM has problems because of the matrix type organization in that he exercises no direct control over his ILSMT members. He does not select team members or the area of a command from which they come. In addition he has no direct input to ILSMT member fitness reports or personnel evaluations. The LM can call ILSMT meetings, but there is no directive that says members must attend the meetings.

Discussion with the F-4 and S-3 ILS managers have indicated that to combat this situation, the LM must have skills and abilities that allow him to communicate with and manage a diverse group of people on a purely person to person basis. He must be able to motivate, stimulate and persuade personnel in the matrix organization in order to accomplish the goals of the ILS program for his weapon system.

The time factor affects the LM's ability to make decisions and act quickly if he does not have the tools to cause things to happen. Decisions by higher authority, changing operational requirements and changing world situation all give rise to the need for action that the LM may not be able to accomplish if the needed authority, accountability, and responsibility are not centralized in his position.

IV. DATA SEARCH AND ANALYSIS

A. DATA COLLECTION

As discussed in Chapter I, data collected consisted of cost, timing and installation information taken from Engineering Change Proposal (ECP) files maintained by the F-4 Logistic Support Manager and his staff at the Naval Air Rework Facility, North Island, California. After an unsuccessful attempt to obtain adequate data from files selected on a random basis, it was found that files having activity subsequent to 1973 were relatively complete and contained the type of information needed for this study. Thus further selection of files for study was made by selecting those that had adequate information.

The final assemblage of data consisted of information from fourteen changes that affected one or more models of the F-4 aircraft or of its engine, the J79. Four of these changes were among those in the original randomly selected group. These are North Island (NI) ECP-226, NI ECP-316, McDonnell-Douglas Corporation (MDC) ECP-864 and MDC ECP-971. Based on official correspondence in the change files and interviews with the Logistic Manager's staff about these specific changes a short commentary was compiled about each change.

B. DATA PRESENTATION

Since only 14 changes out of the approximately 1000 changes on file were examined, a presentation of data from each change is made.

This listing of changes is followed by a chart summarizing major points taken from data on each change. The section is concluded with a discussion of data collected on Integrated Logistic Support Management Teams and funding.

The change summaries that follow are presented in the following format:

CHANGE: ECP designation and AFC/AVC number

APPROVED: Date first approved by CCB.

MEA: Whether or not a Maintenance Engineering Analysis was conducted based on CCB information and interview comments.

PROBLEM INDICATORS: Selected data from the change which indicates variance from desired or planned outcome of the change effort.

COMMENTS: Non-quantitative information about the change.

Change Summaries

1. CHANGE: GE ECP-79H50 PPC-151 Approved 12/71

MEA: No.

PROBLEM INDICATORS

- Installation delay: 3 months from planned start of Oct 72 until Jan 73.
- Kit cost differential: Authorized $24.00 per kit

Contract price	$20.22
Available	3.78
Kits procured X	1600
Savings available	$6048

COMMENTS: Data in file limited. Procurement of kits initiated 5/72 with 36 week delivery which is major contributing factor to delay. MEA would not help.

2. CHANGE: NI ECP-180 AFC-510 Approved 5/72

MEA: No

PROBLEM INDICATORS

- Installation delay: 51 months from planned start of Sept 72 until ? 77.
- Kit delivery status Oct 76: 296 kits ordered and 1 kit delivered
- Kit cost increases

	72	74	increase
Adapter kit	$ 467	$2900	520%
Basic kit	5608	7835	40%

COMMENTS: This change is a retrofit for F4J aircraft that did not have it as a part of production. Install kits were procured from British who decided not to install them. Major problem was price underestimation as a result of over aged items in basic kits, plus additional material required for adaptation to USN aircraft. MEA would not have been of significant assistance in this change.

3. CHANGE: NI ECP-226 AVC-478 REV A Approved 7/73

MEA: No

PROBLEM INDICATORS

- Installation Delay: 30 months from planned start Oct 73 until Apr 76

COMMENTS: Change was prepared as a result of interface problem between AVC-478 and later AVC-862. Neither AVC-478 nor AVC-862 had MEA. Had AVC 862 had a MEA it is possible that there would have been no need for AVC-478 REV. A.

4. CHANGE: NI ECP-291 AFC-568 Approved 6/73

MEA: No

PROBLEM INDICATORS:

- Installation delay: 10 months from planned start date of Sept 73 until July 74.
- Lead time planning: ECP approved 6-73
  Support date 9-73
  Actual kit delivery 5-74
- Reprogrammed Funds: CNO Message 221934Z Jun '73 authorized APN-5 fund reprogramming for kits for this change as follows:

ACFT	OSIP	FUNDS
A-6	35-72	$115 K
F-4	38-70	475 K
A-7	57-70	310 K
CH 46	4-73	500 K
	TOTAL	$1,400 K.

- OMN Funds currently at NARF to be used for installs

CCB	Date	Approved	Installs	For FY	Actual Installs	Dollars Unused
731-745	6/73	3,144,900	700	74	-	$3,144,900

COMMENTS: This emergency requirement for wingfold locklug replacement affected every F4 aircraft. Availability of complete wing panels from Air Force helped resolve this problem. MEA would have helped even if late and should have been able to disclose interchangeability, tooling and spares inventory alternatives which caused delays and problems in managing this change.

5. CHANGE: NI ECP-316 AFC-578 Approved 3/74

MEA: No

PROBLEM INDICATORS:

- Installation delay: 8 months delay from planned start of Sep 74 until May 75

COMMENTS: Change originated to resolve compatability problems between F4N aircraft and AVC-1357. MEA would not help this change, however need for the change could have been eliminated had adequate MEA been conducted on AVC-1357.

6. CHANGE: NI ECP-325 AFC-576 Approved 2/74

MEA: No. Maintenance plan dated 8 Oct 74.

PROBLEM INDICATORS

- Installation delay: 6 months from planned start of Feb 75 until Jul 75.
- OMN Install funds used:

CCB	Date	Approved	Installs	For FY	Actual Installs	Dollars Unused
741-442	2/74	94,000	24	75	1	90,083
741-442S1	10/75	90,000	20	76	35	(67,500)
					NET UNUSED	22,500

Price of installation escalated from $3917 per aircraft to $4500 per aircraft. Planned installation cost for FY 77 is $5339 per aircraft.

- ILSMT action items. Jul. 75: I-Level PGSE still requires maintenance plans. I-Level test set still in design
- Tech manual validation started 26 June 1975.

COMMENTS: This change is part of a series of AWG-10A radar implementing changes. The Maintenance Plan was for

Westinghouse ECP-152 (AVC-1590). However even the late plan was the result of inadequate engineering as subsequent problems showed impact on publications and support equipment much more extensive than anticipated from available data.

7. CHANGE: NI ECP-350 AVC-585 Approved 8/74

MEA: No

PROBLEM INDICATORS:

- Installation Delay: 14+ months from planned start of Nov 75 until present.
- OMN Install Funds Unused

Date	Approved	Installs	For FY	Actual Installs	Dollars Unused
8/74	101,790	65	76	1	100,224
11/75	137,025	75	77	-	137,025
				NET UNUSED	237,249

- Increase in installation costs from $18 per hour to $21 per hour (1974-1975), 17%. Increase in kit cost from $4412.80 to $7012.50; 59%.

COMMENTS: Two major problems with this change; lack of install money at NI and inability to obtain Government Furnished Equipment. Change installs ARC-159 radio in F4 aircraft. Vendor for radio itself has experienced delay in production, and output is going to F-14 and other aircraft

before being supplied to F-4. Since this is a common system to many aircraft, MEA would not have improved situation.

8. CHANGE: MDC-ECP-864 AFC-433 Approved: 5/68

MEA: No

PROBLEM INDICATORS

- Installation Delay: 6 months from planned start of Jun 69 until Dec 69
- MEARS at cost of $10K deleted from approved ECP.

COMMENTS: This ECP changed the intercom system in F4J Aircraft. MEA might have helped. Inadequate data for good analysis.

9. CHANGE: MDC ECP-952 AFC-555 Approved 9/69

MEA: No

PROBLEM INDICATORS

- Installation delay: 12 months from planned start May 74 until May 75
- OMN Install funds used

CCB	Date	Approved	Installs	For FY	Actual Installs	Dollars Unused
721-727R2	11/73	2,543,632	70	75	18	1,889,555
-				76	35	(1,271,816)
721-727S1	7/76	977,184	18	7Q	10	434,304
				NET UNUSED		1,052,043

- Install price escalation from $36338 per acft to $54288

- Kit cost savings

Date	Budget	Actual	Savings Avail
5/26/72	2,640,000	2,475,000	165,000
6/19/75	1,500,000	862,500	637,500
		Net	802,500

- Vendor qualification tests one year after ECP approval identified additional engineering and publications effort costing $24,000.

COMMENTS: In addition to other problems, training personnel identified need for trainer equipment. Had MEA been done, it should have identified these problem areas in the ECP planning stages.

10. CHANGE: MDC-ECP-971 AFC-500 Approved: 12/69

MEA: Yes. Inadequate

PROBLEM INDICATORS

- Installation Delay: 12 months from planned start date of Dec 71 until Dec 72. Installed as part of F4B-N conversion.
- MEARS not procured per MDC ltr of 22 Sep 70.
- Support date of 12/72 not met by spares which were delivered 7/73, 8 months late.
- VTAS Problem review meetings held to resolve many problems arising in Publications, Training, Support equipment. Meetings similar to but were not ILS meetings.

COMMENTS: Preliminary Maintenance Analysis Records and Level of Repair Analysis (21 Jul 72) are dated one year after first aircraft in fleet. The many problems indicate that analysis was inadequate.

11. CHANGE: MDC ECP-1014R1S11 AFC-561 Approved: 12/72

MEA: No

PROBLEM INDICATORS:

- Installation Delay 12+ months from planned start date of July 74 until Jul 75.
- Kit overbudgeting available for possible recapture.

CCB	Date	Budget	Actual Cost	Available
731-326	12/72	1,163,600	1,131,881	31,718
731-326R2	12/73	1,087,447	933,178	154,269
731-326R2	12/73	404,186	347,212	56,974
731-326R3	7/74	570,000	557,430	12,570
			Total Available	$255,531

- APN-5 Spares Modification Kit overrun on kits required per NavAir ltr of 25 Jan 74 vs actual cost on contract 30 Apr 74

Qty	Budget	Actual Qty	Actual Cost	Overrun
120	94260	120	135,646	41,386

- OMN install funds unused

CCB	Date	Approved	Installs	For FY	Actual Installs	Dollars Unused
731, 326	12/72	3, 139, 000	121	74	-	3, 139, 000
731;326R2	7/74	600, 000	30	76	4	520, 000
					Net Unused	3, 659, 000

COMMENTS: Change consists of changing structural components of the aircraft that are subject to fatigue after prolonged aircraft use. MEA would not be necessary for this change.

12. CHANGE: MDC ECP-4021 AFC-577 Approved 9/73

MEA: No

PROBLEM INDICATORS:

- Installation delay: 27+ months from planned start of Jan 75 until April 77
- OMN install funds unused

CCB	Date	Approved	Installs	For Fy	Actual Installs	Dollars Unused
741-510	8/73	150, 000	5	75	-	150, 000
741-510S1	11/74	481, 000	10	76	-	481, 000
741-510S2	10/75	198, 700	4	77	-	198, 700
					Net Unused	829, 700

- Install price escalation from $30, 000 per acft to $48, 100 per acft then to $49, 675 per acft.
- Kit delivery delay of 12 months from planned delivery of Dec 74 until Jan 76.

COMMENTS: Installation delays caused by procurement delivery delay, lack of installation money at NI and lack of key piece of support equipment. MEA would have identified need for support equipment.

13. CHANGE: PPC-161 Approved 11/74

MEA: No

PROBLEM INDICATORS:

- Installation delay: 12+ months from planned date of Jan 76 until ? 77
- OMN Install funds unused

CCB	Date	Approved	Installs	For FY	Actual Installs	Dollars Unused
752-113	11/74	173,938	576	76	-	173,938

COMMENTS: Due to delay in incorporation schedule action on kit procurements suspended in Nov 76. MEA should have found error in GE drawing and identified fact that intermediate level could not install change as planned.

14. CHANGE: PPC-157 Approved 2/74

MEA: No

PROBLEM INDICATORS:

- Installation delay: 3-6 months due to kit shortage after installation began.

- Fund Reprogramming. This safety change has budget of $344,178 which required reprogramming of existing funds. Impact and source of funds unknown.

COMMENTS: In Aug 1976 installation of kit in engines waived until kits become available. MEA would not help since basic problem was installation rate higher than planned.

Summarization Chart

The following chart summarizes key points from all fourteen changes examined. A description of columnar headings and data calculations is provided below.

Change - Changes are listed by ECP number in same order as change summaries in Section B1.

Support affected - McDonnell Douglas Report No. P.S. 408, USN F-4 Composite ILS ECP Status, was primary source for this information while some data was collected from change files.

MEA - Whether or not a MEA was conducted as indicated from change files and interviews with LM personnel.

Delay - Based on comparison of installation commencement as shown on first ECP Milestone Chart (NAVAIR FORM 13051/5) with approximate time of first actual installations commencing as shown in ECP file.

DATA SUMMARIZATION CHART

Change	Support Affected				MEA		Problem Indicators			Kit Over/Under	MEA as key to Problem Prevention		Basic Problem
	Spares	SSE	Trainers	Pubs	Yes	No	Delay (Months)	Net OMN $ Unused	Price escalation	Budget	Yes	No	
1. GE 791150	X			X		X	3			$6048		X	Procurement plans
2. NI 180				X		X	51+		40-520%(kits)			X	Technical data
3. NI 226	X		X	X		X	30				X		Lack of MEA on AVC 862
4. NI 291	X			X		X	10	3,144,900*			X		Procurement + technical plans
5. NI 316				X		X	8				X		Lack of MEA on AVC 1357
6. NI 325	X	X	X	X		X	6	$22,500	15-19%(Install)		X		Inadequate engineering
7. NI 350	X	X	X	X		X	14+	$237,249	59%(Kits)			X	NARF install $; GFE
8. MDC 864	X		X	X		X	6				X		n.a.
9. MDC 952		X	X	X		X	12	$1,052,043	49%(Install)	$802,500	X		Inadequate engineering
10. MDC 971	X	X	X	X	X		12				X		Inadequate engineering
11. MDC 1014R1S11	X	X	X	X		X	12	$3,659,000		$255,531		X	Installation time +$
12. MDC 4021	X	X	X	X		X	27	$829,700	65%(Install)		X		Lack of MEA, install $
13. PPC 161	X			X		X	12	$173,938			X		Drawing error
14. PPC 157				X		X	6					X	Planning

* If expended would have come from funds already budgeted for by other changes

n.a. Not available.

Net OMN $ Unused - As an indication of variance from the change planned installation rate, this figure is the net of the planned OMN fund usage from CCB Change Request (NAVAIR FORM 13050/2) and the author's estimation of costs (based on a per unit basis) that would be incurred as the change was actually installed each fiscal year (cost estimate found by dividing budget by number of planned installs). Actual cost information was not available in the LM's files.

Price Escalation - Another indicator of variance and impact of delay. Percentages are calculated from change in installation price and kit price changes during delay of installation.

Kit over/under budget - Figure taken from comparison of dollars approved on CCB Change Request Form and final contract price where contracts were available for examination. Objective is to show impact of budgeting for ILS elements.

MEA as key to Problem Presentation - After changes were reviewed LM personnel were asked if a complete MEA were done could it have reasonably expected to resolve the problem encountered in implementation of the change. Results summarized as Yes or No answer. (Refer to comments on each individual change for additional data)

Basic problem - Comment concerning what LM personnel believe to be the underlying cause to the problems experienced during change implementation

Integrated Logistic Support Management Teams

Due to the continued importance of the F-4 to the Navy as a first line fighter aircraft, management efforts to keep the aircraft up to date have resulted in several service life extension programs and the implementation of many major changes to the various models of the F-4. To monitor these programs the LM has established five Integrated Logistic Management Support Teams: The F-4J to S ILSMT, AWG-10A ILSMT, F-4 B to N ILSMT, Project Sure (Sensor Update and Refurbishment Effort - RF4B) ILSMT and J79 (ENGINE) ILSMT.

A review of membership on the various teams showed that the four aircraft teams were composed of essentially the same personnel and that meetings for each ILSMT were held semiannually or more often in some cases. The membership on the J-79 engine ILSMT, while representing all ILS elements, was composed of different personnel than the other teams which reflects the separate management of engines within the Navy. Attendance at the ILS meetings for the F4B-N ILSMT was charted from 1973 to 1976 (6 meetings). Attendance by the key LEM's is shown below.

Support Area	LEM	Attendance
Publications	NATSF	33%
Spares	ASO	83%
Support equipment	NAEC	83%
Trainers	NAMTRAGRU	66%

Funding

Funding records examined were limited to funds approved by the CCB and some contracts which were on file in the LM office. The LM did not keep records of funds budgeted for comparison with funds expended in the case of APN-6 and OMN dollars. At the time of data collection, the LM was implementing a system to maintain this information for APN-5 funds.

It was determined that the LM responsibility for the funds affecting his weapon system in terms of budgeting, defending before budget committees and finally spending the dollars was different for each of the three funds he managed.

	APN-5	APN-6	OMN
Budget	Yes	Yes	Yes
Defend	Yes	Yes	No
Spend	Yes	No	No

APN-6 dollars are spent by various logistic element managers and NAVAIR. OMN dollars are defended by NAVAIR and spent by NAVAIR.

C. DATA ANALYSIS

The key to the overall condition of the F-4 changes is the Data Summarization Chart which displays several areas of variance from expected change outcome. Every change examined was delayed from three to fifty-one months before installation with an average delay of fifteen months for the fourteen changes. Another variance can be seen where OMN funds are not utilized as planned due to delays from planned start of change installation and delays in the aircraft rework induction schedule. Price escalation factors are noticeably large on some of the delayed changes.

Probably the most significant fact observed from the data is the lack of a MEA on all but one change. F-4 LM personnel have stated that early engineering analysis conducted when originating the ECP (see figure 1, Chapter II) is only the minimum necessary to document the change. The adverse impact of this policy is evident when it is noted that an adequate MEA should have located the problems in 9 of the 14 changes examined. This seems even more significant when contrasted to a new weapon system acquisition process where the MEA and Logistic Support Analysis become key factors in decisions on costs and production.

Further evidence of the importance of the MEA is exemplified by ECP's 226 and 316 which could both have been eliminated had a MEA been done on a previous change. Other changes evidence problems of

such things as the change being more complex than early engineering indicated; new support equipment need was not identified by early engineering; trainers were not planned for; installation equipment needs were not forseen.

The funding situation has a specific impact on the engineering effort and MEA. At the beginning of the change process when the ECP is originated, budgeting is just beginning and funds are not available to pay for in depth engineering analysis. The decisions made in this early engineering effort seem to be accepted as final, and further analysis may not be purchased when money does become available.

Once funds are budgeted, the problem of fund control becomes evident. From the information collected it is seen that the LM budgets for all funds needed but must defend his budget for only two of the three funds and he may anticipate spending money for but one of the funds.

The problems in OMN expenditure are shown on the Data Summary Chart and further delineated in Figure 5 showing what might happen to the OMN pot based on change installation and non-installation of a few of the changes where data were available for estimation of use of planned OMN dollars. Actual dollars used were not available at the LM office. In this example funds from three fiscal years would have gone unobligated, been used for other F-4 change installations, or

OMN DOLLARS NOT USED IN YEAR PROGRAMMED

CHANGE	FY: 74	75	76	77
ECP 291	3,144,900[1]	--	--	--
ECP 325	--	90,083	--	--
ECP 350	--		100,224	137,025
ECP 952	--	1,889,555		434,304
ECP 1014R1S11	3,139,000	--	520,000	
ECP 4021		150,000	481,000	198,700
PPC 161			173,938	
(1) TOTALS	3,139,000	2,129,638	1,275,162	770,029

OMN DOLLARS USED IN YEAR OTHER THAN PROGRAMMED (AT ESCALATED RATES)[2]

CHANGE	FY: 74	75	76	77
ECP 291	--	1,536,606[3]	1,563,564	
ECP 325			67,500	48,051[4]
ECP 952			1,271,816	
(2) TOTALS	--	1,536,606	2,902,880	48,051
NET (1-2)	3,139,000	593,032	(1,627,718)	721,978

Figure 5

Notes - Figure 5

1. No change installed thus no impact on these unprogrammed funds. Had installations been installed funds needed would have come from existing funds for other changes.
2. Assumes changes uninstalled from previous years must be done at rates programmed for FY in question.
3. Assumes change installed at rate of 57 per month starting Jul 74 utilizing existing funds.
4. Assumes 8 remaining kits will be installed at FY 77 rate of $5339 per aircraft.

used to support other aircraft. In fiscal year 76 the over-obligation of funds would take money planned for other aspects of the F-4 or money programmed for another aircraft type. This kind of situation existed in the case of ECP-350 and ECP-4021 where OMN installation funds had been approved but at installation time funds were not available at NI to do the work thus causing a delay in the change installation.

At the LM level there is no provision for record keeping on the various funds. It was found that none were maintained until recently when a local record of APN-5 budget vs obligations was established. Without such records unused funds revert to NAVAIR for use as that command sees fit. Without some kind of feedback on APN-6 and OMN dollar expenditures the logistic manager's budgeting will contain inaccuracies because of the uncertainty as to what actual costs have been in the past.

As noted in Chapter II, the personnel impact on ILS can be significant, with the key to personnel management being communications. One comparison of interest made was attendance at F4B-N ILS meetings by key LEM's vs support affected in the various changes examined (from Data Summary Chart). This comparison is shown below.

Support Area	F4B-N ILS Meeting Attendance	Support area affected by 14 changes examined
Spares	83%	71%
Publications	33%	100%
Support Equipment	83%	43%
Trainers	66%	57%

This comparison is in no way conclusive but it does serve to indicate that lack of attendance at ILS meetings may place an additional burden on the communications channels and may contribute to maintaining sociological communications barriers.

V. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

The data collected in the process of this study indicate the existence of several areas of deficiency, creating conditions that may have an adverse affect on the outcome of the change process. The conclusions listed below point out these specific areas. It is recognized that conclusions must be tempered by the fact that time and dollars available only permitted gathering minimal data. However, similar conclusions arrived at by the Naval Audit Service Report (Z60046) through a different means of analysis serve to give credence to the conclusions of this thesis.

As the result of this study and data analysis the following conclusions have been arrived at subject to the qualification that additional data needs to be gathered for statistically significant results.

- The change process itself is not supportive of logistical needs.
- Failure to conduct maintenance engineering analysis on specific changes has been responsible for unsatisfactory outcome of the change process.
- Lack of a comprehensive funding policy for the F-4 weapon system has affected weapon system manager's ability to control

expenditures for the F-4, to account for monies assigned to the F-4 weapon system and to assess the impact of changes of funding on the F-4 program.

- Inadequate personnel management and training in the areas of personal interrelationships has fostered communications problems, conflict situations, and personnel insecurity which may have contributed to difficulties in the change process.

B. RECOMMENDATIONS

Based on the data and conclusions presented, several recommendations are offered as specifics for future study and possible solutions to problems identified.

- Required MEA at time ECP is originated. Further study of a cost/benefit analysis might compare benefit (cost) of MEA as opposed to cost of delays in terms of funds lost, price escalation, etc.
- Establishing a weapon system funding policy which will provide the weapon system manager and logistic manager with control of funds throughout the entire change process. Future study of such a concept could endeavor to determine whether actual fund expenditures at various logistic activities were equal to expenditures planned by the LM and how differences were accounted for.

- Restructuring of the change process itself to include MEA at ECP origination, bringing the LM to the same level of review as class desk engineer and establishing check points in the process whereby logistical procurements can be started, stopped, slowed or otherwise managed to better control use of funds and improve the outcome of the change itself.
- Further study into the personnel management and training of people involved in the ILS process to facilitate development of skills needed to work in the ILS program.

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